ABSTRACT

A method for estimating the frequency of a single frequency complex exponential tone in additive Gaussian noise, comprising the steps of: performing the fast Fourier transform (FFT) on the tone; estimating the frequency as the frequency corresponding to the largest FFT output coefficient magnitude; computing a discriminant which is proportional to the frequency error in the initial frequency estimate using modified coefficients of the discrete Fourier transform (DFT) with center frequencies plus one half and minus one half of the FFT bin spacing relative to the initial frequency estimate; mapping the value of the discriminant into the estimate of the frequency error in the initial frequency estimate using a mathematically derived function; adding the estimate of the frequency error to the initial frequency estimate to get a first interpolated frequency estimate; computing a further discriminant which is proportional to the frequency error in the first interpolated frequency estimate using modified coefficients of the discrete Fourier transform (DFT) with center frequencies plus one half and minus one half of the FFT bin spacing relative to the first interpolated frequency estimate; mapping the value of the further discriminant into the estimate of the frequency error in the first interpolated frequency estimate using the mathematically derived function; and adding the estimate of the frequency error in the first interpolated frequency estimate to the first interpolated frequency estimate to get a second interpolated frequency estimate.